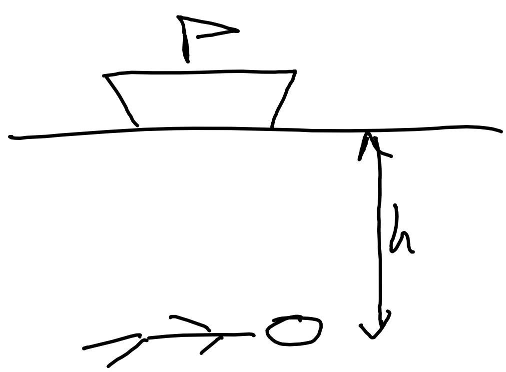
Example 1



Repture : pressure > 35 kPa.

$P = \rho g h$.

$P = 35 \times 10^3$ Pa.

$\rho = 1030$ kg/m³

$g = 9.81$ m/s²

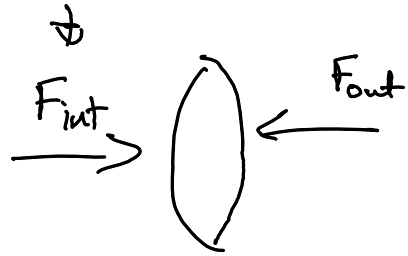
$h = ?$

$P = \rho g h$

$$h = \frac{P}{\rho g}$$

$$h = \frac{(35 \times 10^3 \text{ Pa})}{(1030 \text{ kg/m}^3)(9.81 \text{ m/s}^2)}$$

$h = 3.46$ m.



b) Force.

$$P = \frac{F}{A}$$

$F = P \cdot A$

$P = 35$ kPa.

$A = \pi r^2$

$$r = \frac{d}{2} = (1 \times 10^{-2} \text{ m})$$

$$r = \left(\frac{0.01}{2}\right) = 0.005 \text{ m}.$$

$A = \pi (0.005)^2$

$A = 7.85 \times 10^{-5}$ m².

$F = (35 \times 10^3 \text{ Pa})(7.85 \times 10^{-5} \text{ m}^2)$

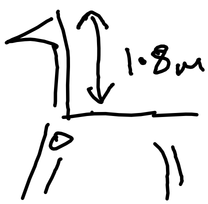
$F = 2.75$ N

Example 2

Giraffe on Earth.

$g_E = 9.81\ m/s^2$

$\rho = 1060\ kg/m^3$



Normal blood pressure at heart 220/180 mmHg.

$P = \rho g h$. → pressure drop due to height

$= (1060)(9.81)(1.8)$

$P = 10,400\ Pa$.

$1\ mmHg = 133.32\ Pa$.

$P = 78\ mmHg$ → pressure drop

$220 - 78 = 142\ mmHg$

$180 - 78 = 102\ mmHg$

Blood pressure at brain on Earth <u>142/102</u>

Giraffe on Moon.

$g_M = 1.63\ m/s^2$

$P = \rho g h$

$= (1060)(1.63)(1.8)$

$= 3,110\ Pa$.

$P = 23\ mmHg$

$220 - 23 = 197\ mmHg$

$180 - 23 = 157\ mmHg$

Blood pressure

<u>197/157</u>

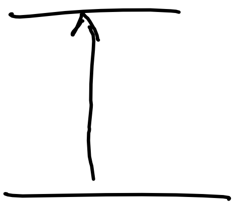
↑ 55 mmHg more pressure.

Example 3

$P = 100\ mmHg$

$1\ mmHg = 133.32\ Pa$

$100\ mmHg = 13{,}332\ Pa$



$$\Delta P = \rho g h$$

$$h = \frac{\Delta P}{\rho g}$$

$$h = \frac{(13{,}332\ Pa)}{(1060)(9.81)}$$

$$h = 1.28\ m$$

Example 4:

$m = 70$ kg

$\rho_e = 1010$ kg/m³ — density after exhalation.

$\rho_w = 1000$ kg/m³ — density of water.

Inhale $2L = 2 \times 10^{-3}$ m

When we exhale

$\rho_e > \rho_w$

1010 kg/m³ > 1000 kg/m³ $\Rightarrow$ we sink.

But when we inhale our volume increases. and therefore our density changes

V_e = volume when we exhale.

V_i = volume when we inhale.

$V_i = V_e + 2L.$

$\Rightarrow$ What is V_e?

$\rho_e = \frac{M}{V_e}$ $\quad M = 70$ kg, $\rho_e = 1010$ kg/m³

$\Rightarrow V_e = \frac{M}{\rho_e}$

$V_e = \frac{70 \text{ kg}}{1010 \text{ kg/m}^3} = 6.93 \times 10^{-2} \text{ m}^3$

↑ Volume when we exhale.

$\Rightarrow V_i = V_e + 2L$

$= (6.93 \times 10^{-2} \text{ m}^3) + (2 \times 10^{-3} \text{ m}^3)$

$= 7.13 \times 10^{-2} \text{ m}^3$

↑ Volume when we inhale.

$\Rightarrow$ What is our density when we inhale?

$\rho_i = \frac{M}{V_i} = \frac{70 \text{ kg}}{7.13 \times 10^{-3} \text{ m}^3} = 982 \text{ kg/m}^3.$

$\rho_w = 1000$ kg/m³

$\Rightarrow \rho_i < \rho_w$

982 kg/m³ < 1000 kg/m³ so he floats.